Enterprise Streaming Services With Quicktime

Session 628

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Enterprise IT

Enterprise Streaming Services With Quicktime

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Enterprise Streaming Services With Quicktime

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Introduction

- QuickTime in the enterprise key issues
- Webcasting solutions
- Multicast
- Auto-bandwidth detection
- Advocacy

What You'll Learn

- How QuickTime 7 and Tiger Server fit enterprise needs
- Deploy QuickTime to Windows desktops
- Case study: AEP-TV video portal
- Webcast multiple live H.264 multicast streams with Wirecast
- Use auto-bandwidth detection in QuickTime 7

Technology Framework

Xserve G5

Xserve RAID

Mac OS X Server

QuickTime
Streaming Server

Wirecast

What a Difference a Year Makes

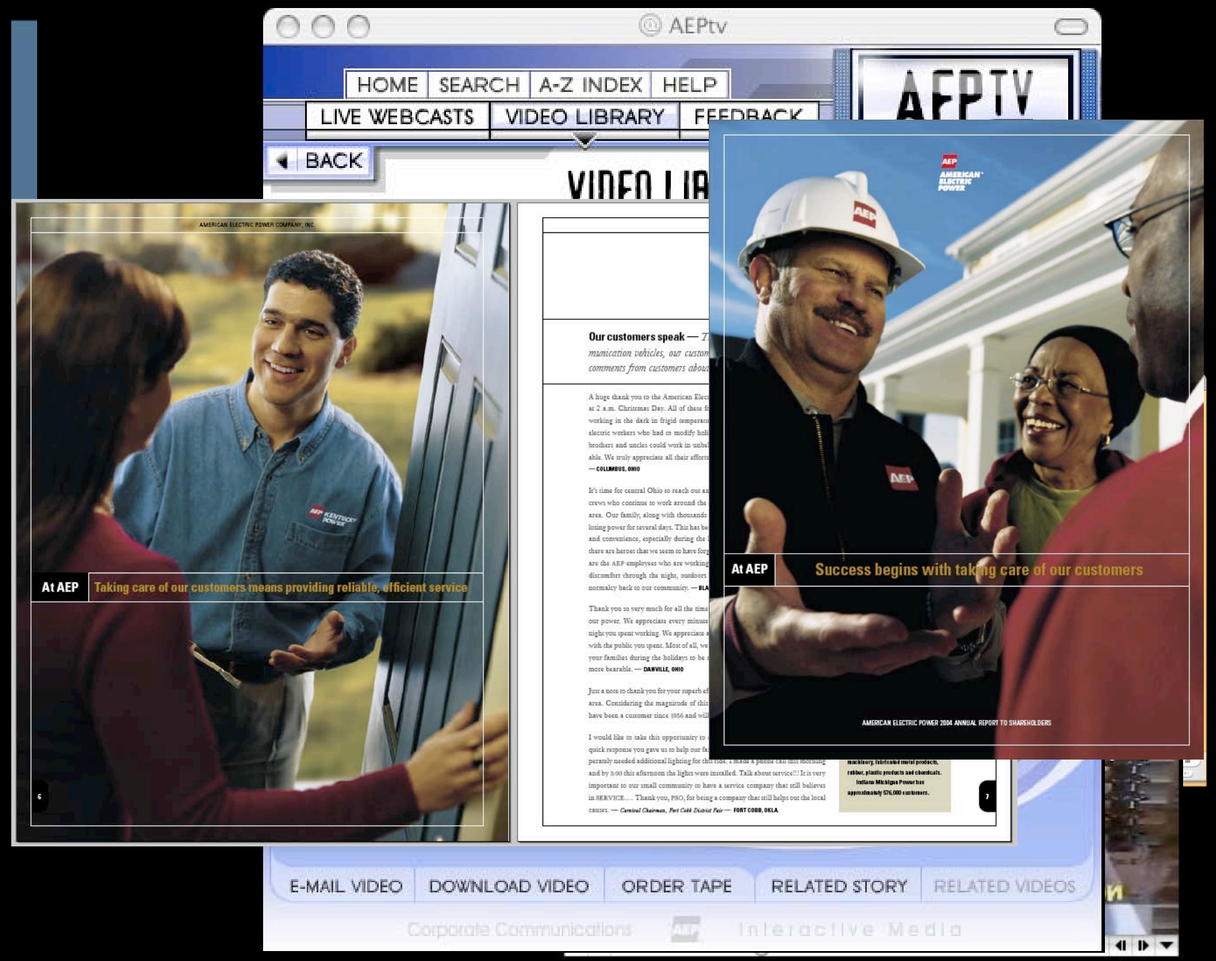
- QuickTime 7—H.264, no more Pro nag… ;-)
- QTSS 5.5—auto-bandwidth detection with QuickTime 7
- Broadcaster 1.5—H.264, hi-res DV capture
- Wirecast 2—webcast multiple H.264 streams
- Compressor 2—distributed encoding
- Tiger—multiparty H.264 video conferencing in iChat
- Tiger Server—Jabber Server: secure, firewall-safe iChat

Background

Who is American Electric Power?

- Largest electricity generator in U.S.
- Five million customers
- 11-state service territory, from Ohio to Texas
- 20,000+ employees @ 400+ locations

AEP AMERICAN® ELECTRIC POWER



Background

Corporate communications > interActive media

- AEP.com Internet site
- AEPNow intranet
- AEP-TV video portal
- 200+ video projects
- 25+ live webcasts
- Annual report and other print needs

Why We Use QuickTime in Enterprise

- QuickTime-based video production workflow (FCP, Avid)
- One player for all Windows clients
- Clean, fast player UI with Instant-On, scrubbing
- Immunity from Windows viruses and attacks
- Low cost vs. Windows Enterprise Server
- Open standards (MPEG-4, RTSP)
- Excellent video quality (H.264)

Deploying QuickTime Player

- QuickTime site license (free)
- Test on all desktop configurations
- Set prefs (auto update, HotPicks movie…)
- Update disk images for new PCs
- Build custom installer (LANdesk)
- Detect user config (BrowserHawk)
- Drive deployment with content

AEP-TV

A web-based enterprise video portal

- All videos and live webcasts
- By subject or keyword
- Promotes new content
- Ties in to AEPNow
- Viewer stats, feedback, email, download, orders
- Database-driven back-end admin

Demo

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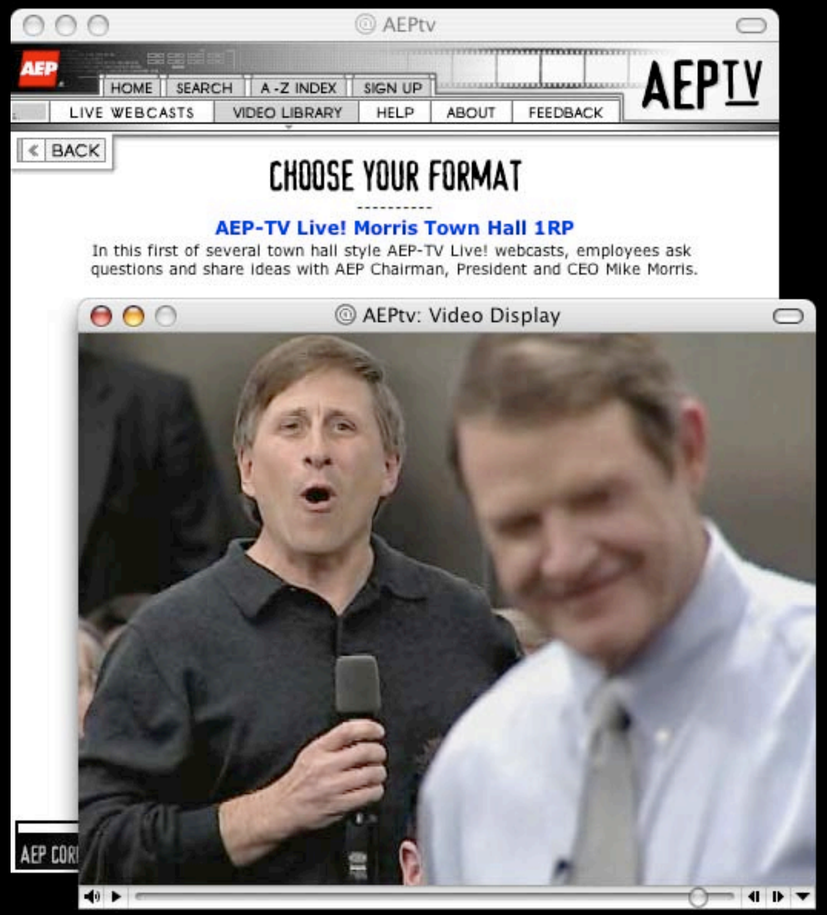
http://developer.apple.com/wwdc2005/



Live Webcasts

Enter at own risk

- Why? Audience interaction and/or big news
- Promote it
- Multicast inside, CDN outside
- Post archive quickly
- Track viewers to gain political capital with management
- Webcasts a critical link between employees and management

Webcasting Studio

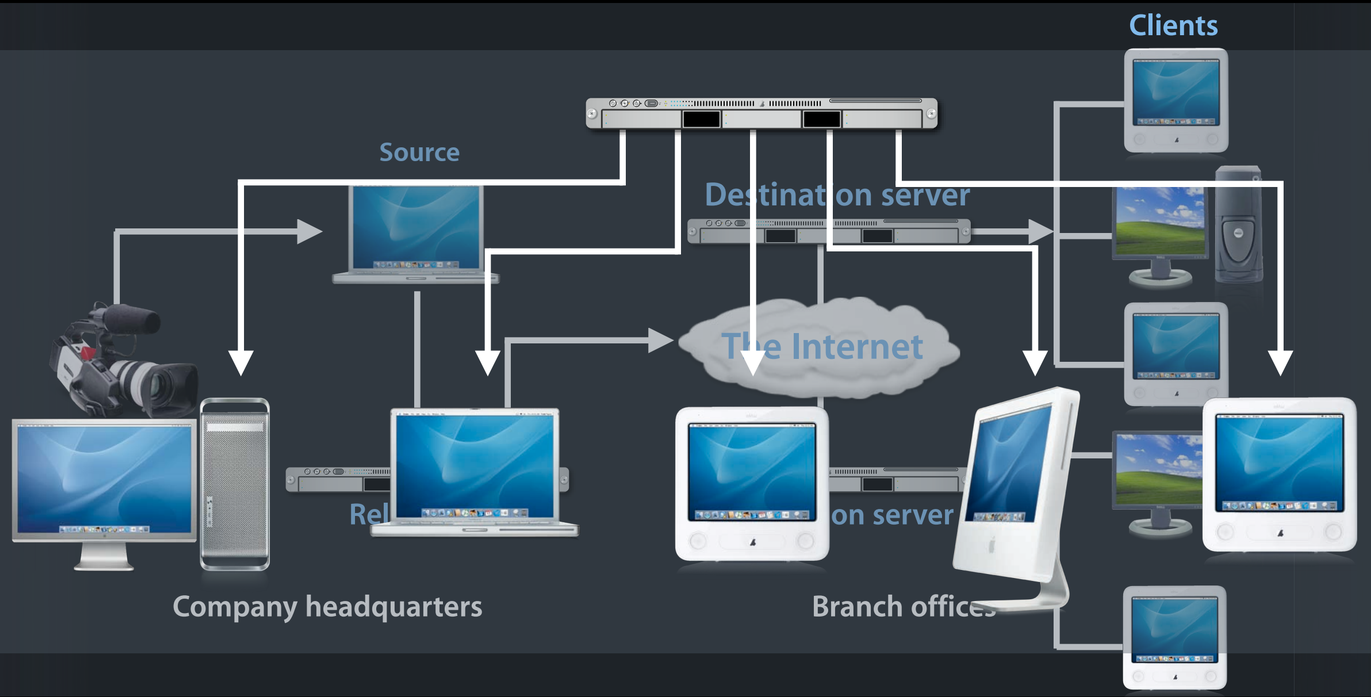
- Good content first priority
- Script and rehearse
- High-quality lighting, audio, cameras, video switcher
- Enable audience interaction via web and/or phone call-in
- Fast G5 with QuickTime Broadcaster or WireCast
- For best quality, use capture card (AJA, DeckLink, etc.)

QuickTime H.264 Webcasting Solutions

- QuickTime Broadcaster
  - Free
  - High-quality DV capture
  - Simple, but limited feature set
- Wirecast
  - $449
  - Multiple H.264 streams
  - Multiple source switching, cropping, advanced preview…

Unicast

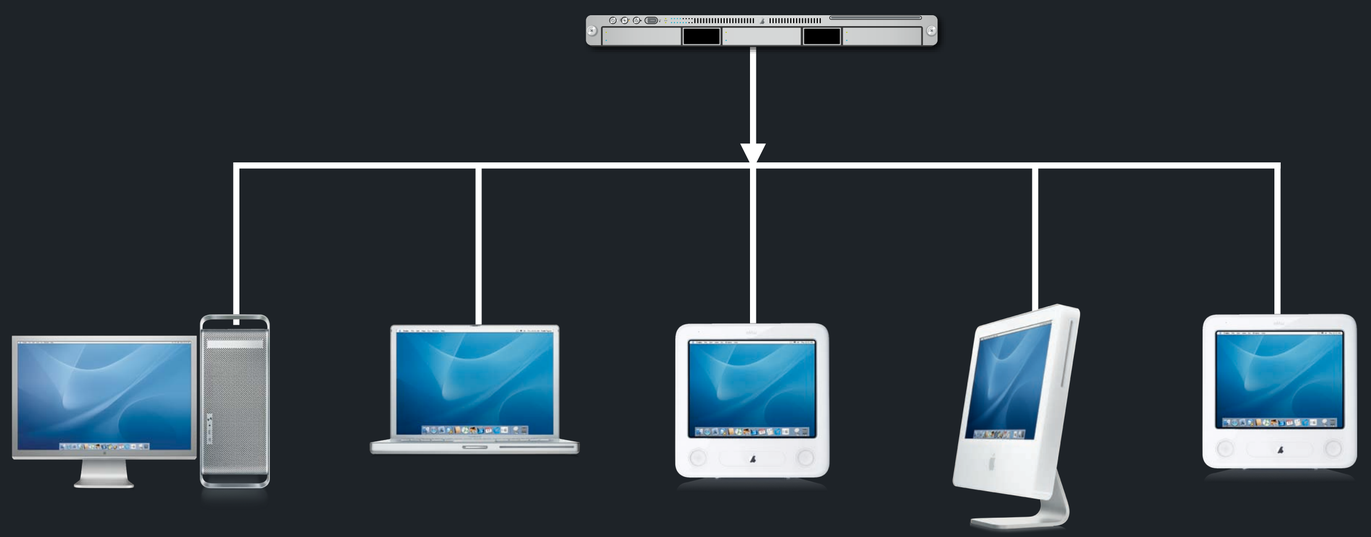
- One stream per viewer
- Many viewers overload network and server(s)
- Relay servers a partial solution
- Unicast only method for on-demand and public Internet



Multicast

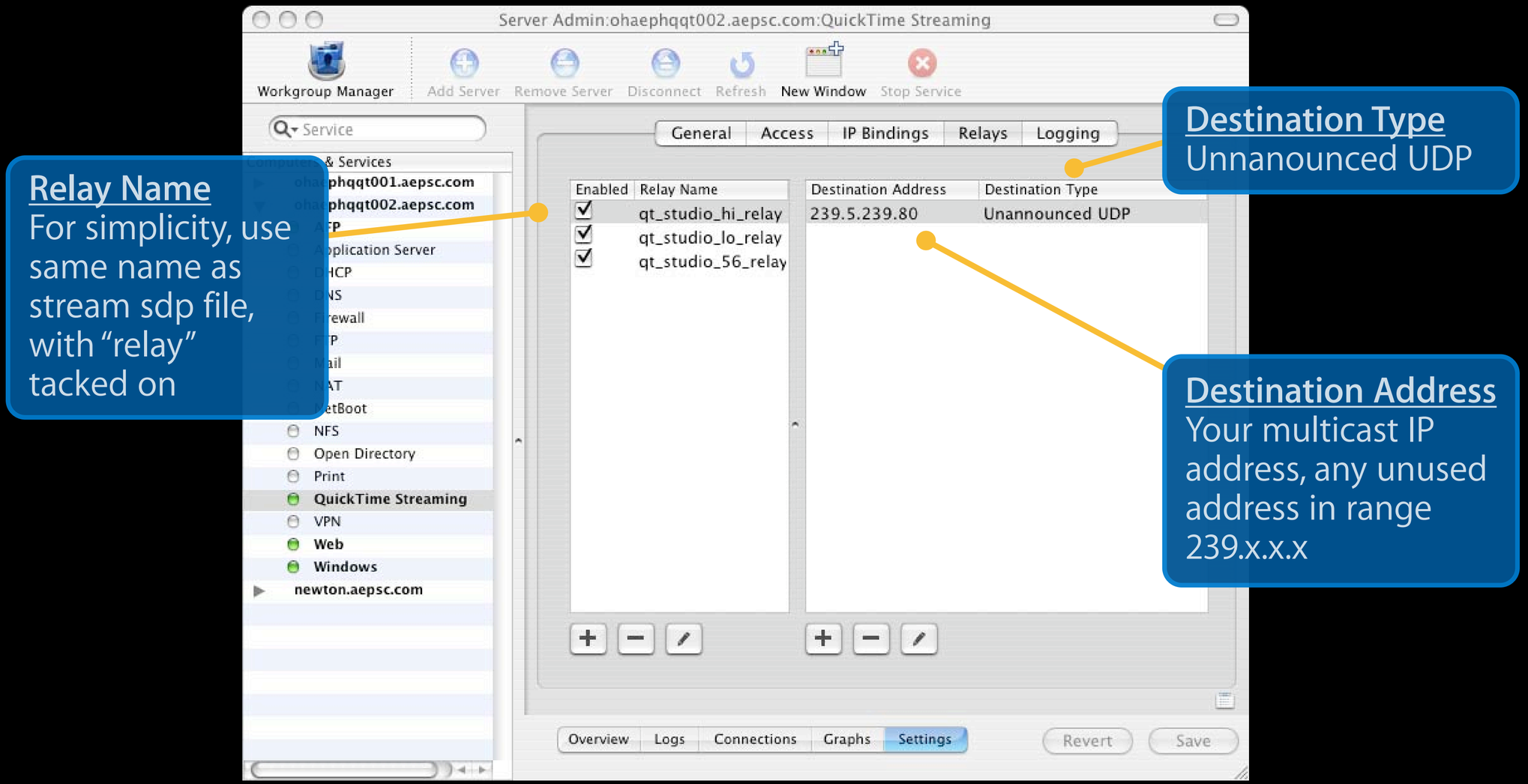
- Conserves network and server bandwidth for live webcasts
- Cheaper than relay servers
- But…must work with IT to enable it (time and $$$)
- Unicast from encoder to server; relay a multicast to network

Multicast



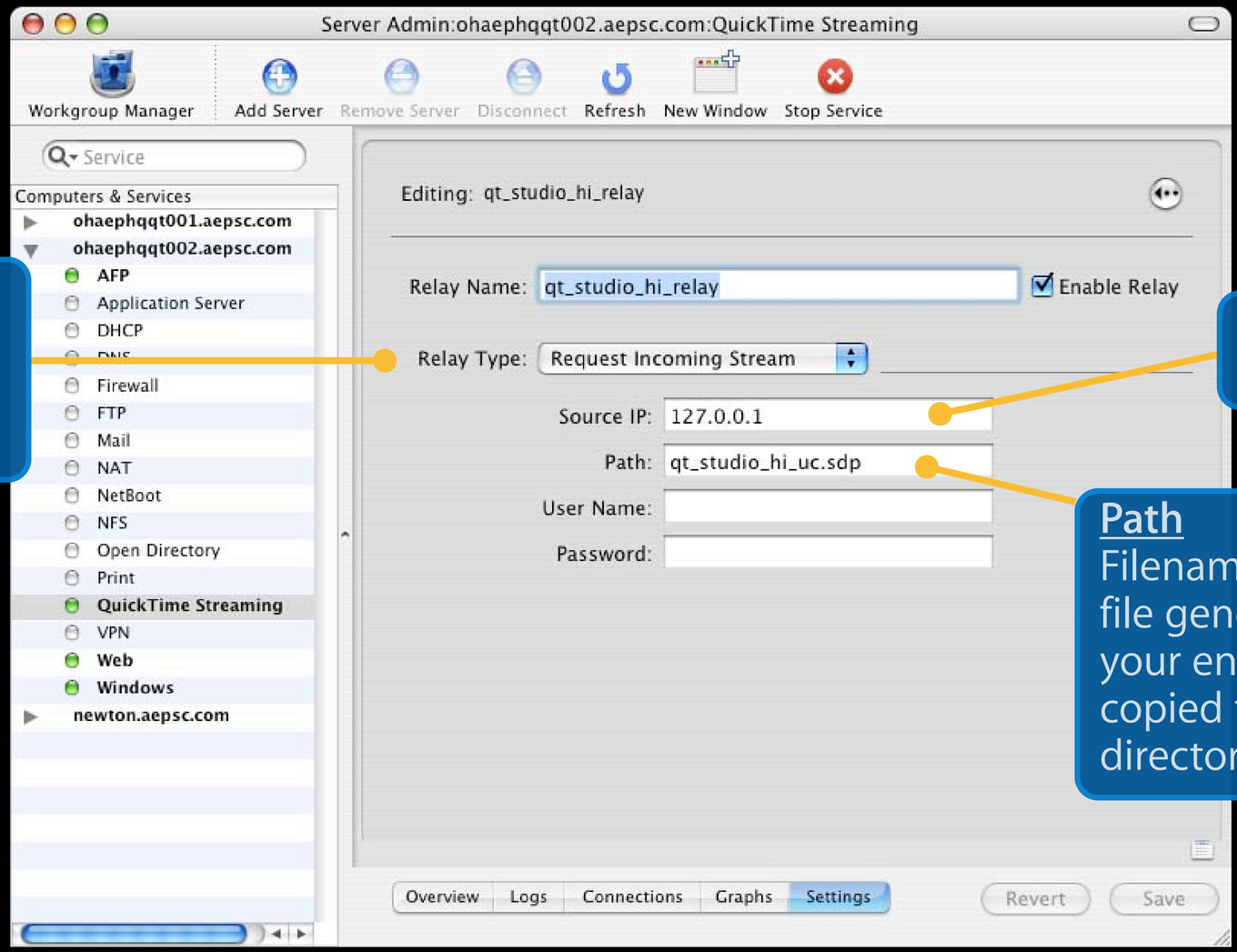
Setting Up a Multicast Relay

Server Admin > QuickTime Streaming > Settings



Setting Up a Multicast Relay

Edit Relay



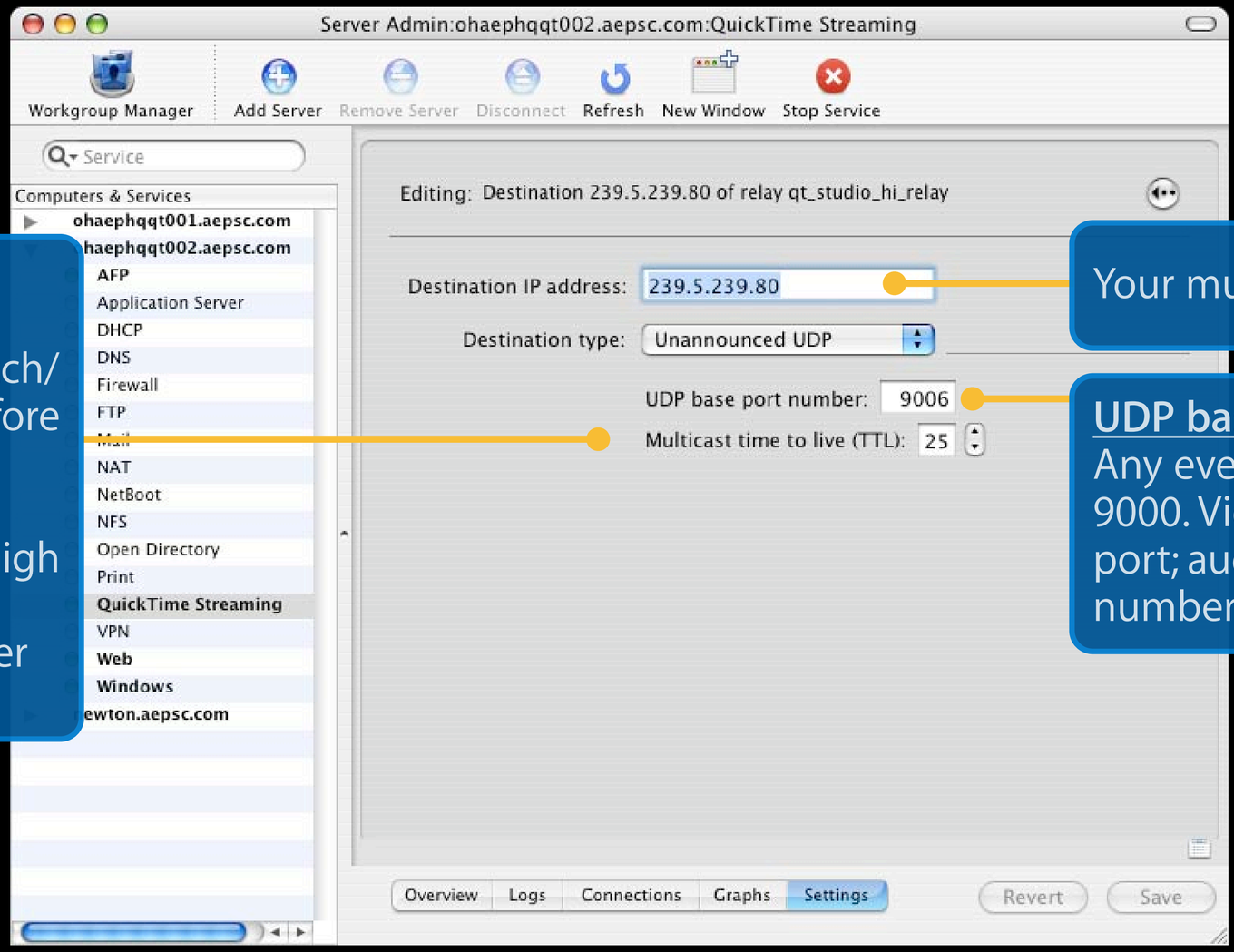
Relay Type
Request Incoming Stream

Source IP
127.0.0.1 (self)

Path
Filename of unicast .sdp file generated from your encoder and copied to QTSS media directory

Setting Up a Multicast Relay

Edit Destination (Info for Multicast .sdp File)



TTL
(Time To Live)
Number of switch/ router hops before multicast dies.

Set at least as high as number of hops from server to users.

Your multicast IP address

UDP base port number
Any even number over 9000. Video will use this port; audio will use this number + 2 (i.e. 9002).

Creating a Multicast sdp File

- Start with unicast sdp file, but change destination address and port numbers to match relay

```
v=0
o=none 822399460 822399460 IN IP4 10.88.1.220
c=IN IP4 10.88.219.228
t=0 0
m=audio 5434 RTP/AVP 96
a=rtpmap:96 mpeg4-generic/22050/1
a=fmtp:96 profile-level-id=15;mode=AAC-
hbr;sizelength=13;indexlength=3;indexdeltalength=3;config
=1388
a=control:trackid=1
m=video 5432 RTP/AVP 97
...
```

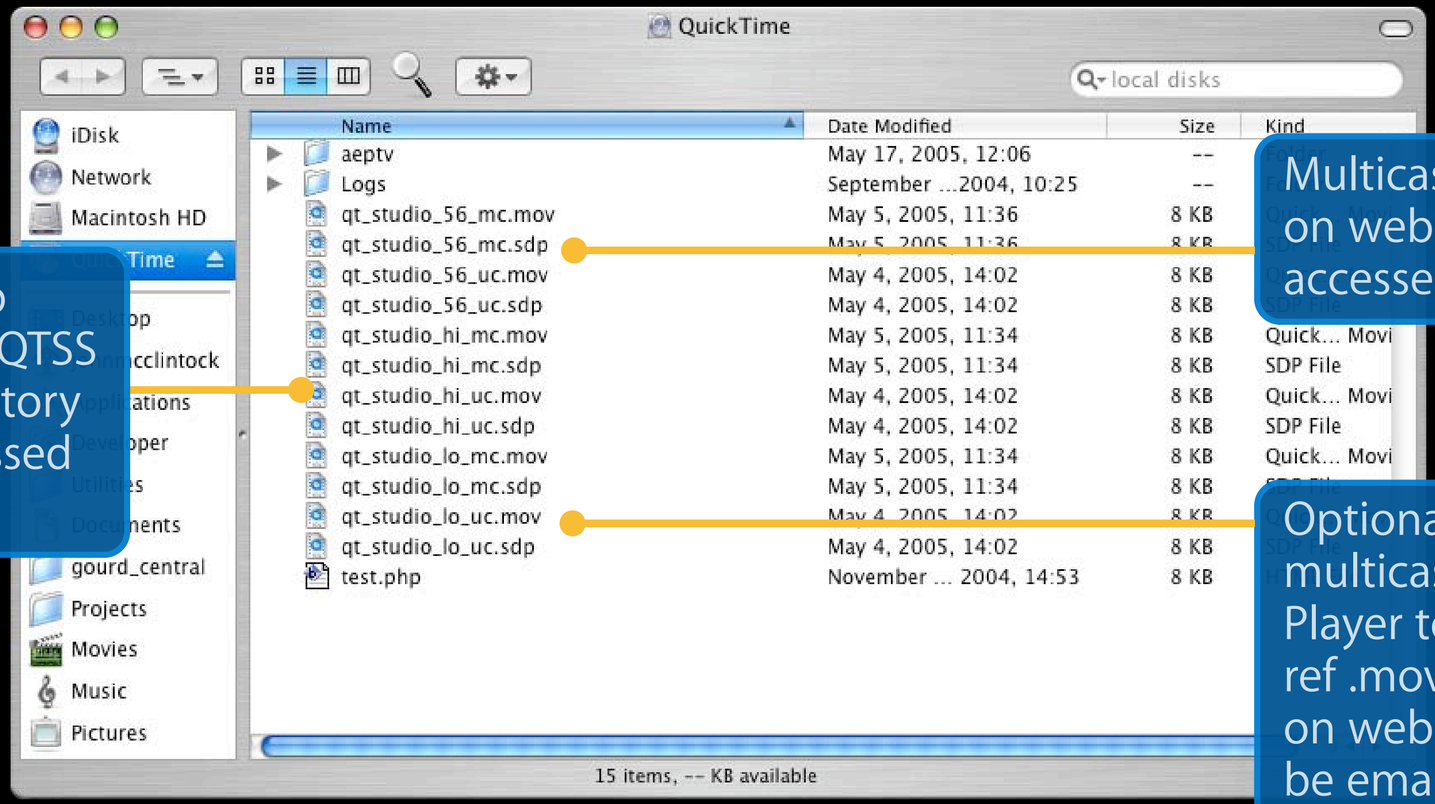
Creating a Multicast sdp File

- Start with unicast sdp file, but change destination address and port numbers to match relay

```
v=0
o=none 822399460 822399460 IN IP40.0.0.0
c=IN IP4239.5.239.76
t=0 0
m=audio9006RTP/AVP 96
a=rtpmap:96 mpeg4-generic/22050/1
a=fmtp:96 profile-level-id=15;mode=AAC-
hbr;sizelength=13;indexlength=3;indexdeltalength=3;config
=1388
a=control:trackid=1
m=video9008RTP/AVP 97
...
```

Multicast sdp File

Organize and Name Files Rationally



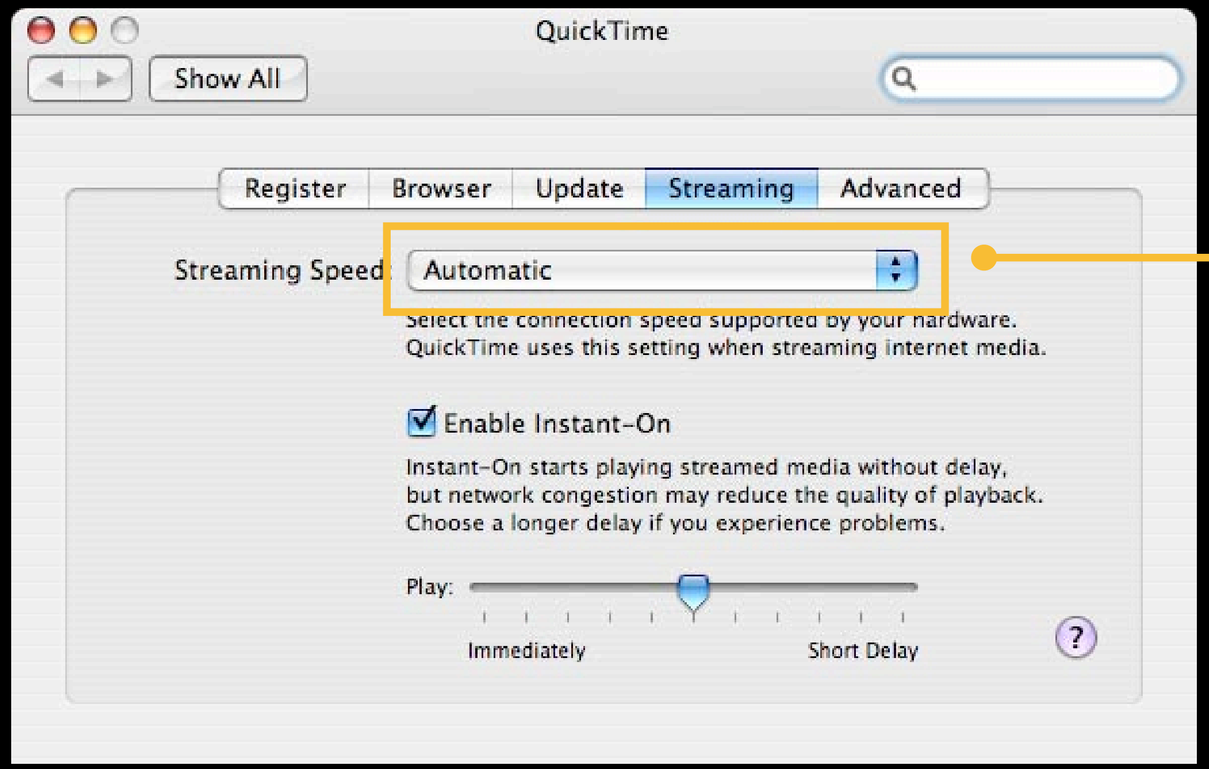
Unicast .sdp file stays in QTSS media directory and is accessed via rtsp://...

Multicast .sdp file goes on web server and is accessed via http://...

Optionally, open multicast .sdp file in QT Player to export ref .mov, which goes on web server or can be emailed

Auto-Bandwidth Detection

QuickTime 7 and QTSS 5.5



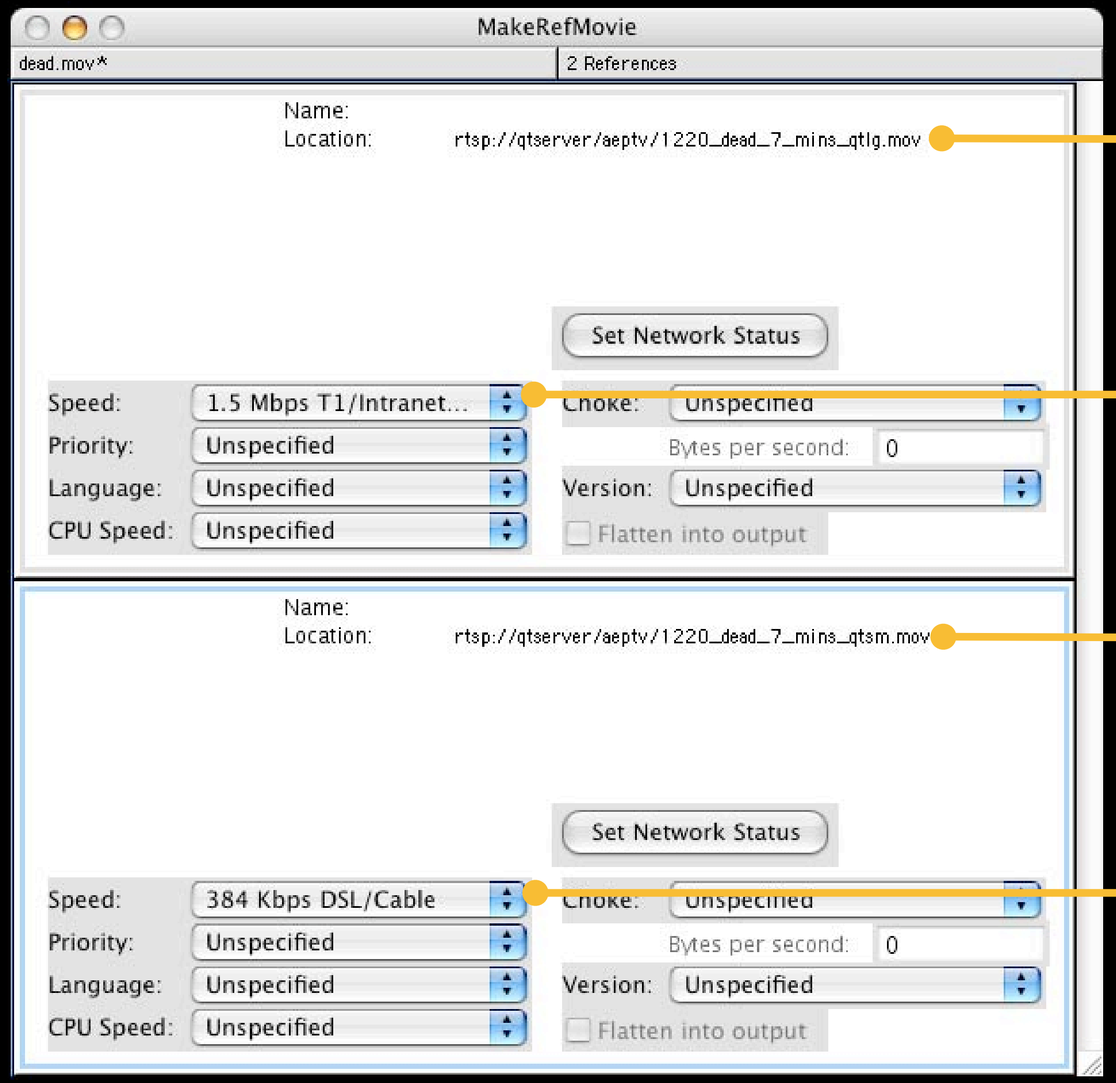
Connection Speed
Automatic is default setting QT 7 Player

QuickTime 7 Auto-Bandwidth Detection

- Uses existing ref movie method, so backwards compatible
- For RTSP streaming, requires Tiger Server
- For progressive download, works if web server supports HTTP 1.1 byte range
- QT7 Player measures connection speed by timing download of small cache file, then picks best match from ref movie
- Some limitations, but a good start

Auto-Bandwidth Detection

MakeRefMovieX



URL of 1st version

Minimum connection speed required

URL of 2nd version

Minimum connection speed required

Demo

Nate Caplin
ncaplin@aep.com

http://developer.apple.com/wwdc2005/

Give Apple Feedback—Friday @ 5:00p

- QuickTime Player—fullscreen playback without Pro; free, customizable enterprise installer
- Broadcaster—multiple streams; keynote integration
- QTSS—simplified multicast setup; unicast rollover
- QTSS Publisher—better file management; ingestion of existing QT files into library; syncronization across servers; viewer stats
- OS X Server—IP failover w/mirroring and load balancing

Wrap Up

http://developer.apple.com/wwdc2005/

Who to Contact

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AEP Studios
More information, examples from AEP's corporate webcast studio
http://www.aepstudios.com/

For More Information

http://developer.apple.com/wwdc2005/

Documentation, Sample Code, and Other Resources

http://developer.apple.com/wwdc2005/

Enterprise IP Video Delivery

Digital Academic Television Network (DATN)

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http://developer.apple.com/wwdc2005/

Introduction

- Discuss an IP-based video delivery system based on QuickTime technologies
- The University of Wisconsin—Madison wanted to replace an existing CATV infrastructure with an IP-based system, taking advantage of a large network upgrade initiative currently in progress
- Many options from different vendors were examined, and the university eventually decided on QuickTime technologies
- Apple server technologies were a good fit for delivering a QuickTime-based solution

What You'll Learn

- The decisions that went into beginning a move from a traditional CATV cable plant to an IP network for video delivery
- How the University of Wisconsin deployed a pilot system for a large-scale live streaming project using cable television as the initial content
- The hardware, software, and practices used in deploying this system

Background

- The university previously operated its own cable video infrastructure for several years, called the Academic Television Network (ATN)
- In addition to local content, an agreement with our local cable operator allowed the university to carry a selection of cable TV channels
- ATN became difficult and expensive to maintain
- The Digital Academic Television Network (DATN, pronounced “Dayton”) is a system to deliver video over a new Internet Protocol (IP) network at the University of Wisconsin—Madison. The previous agreement with our cable operator is the basis for channel carriage on DATN
- It is interesting to consider the history of the network, as a network morphs from cable television to data and then to both

Roots of DATN

The roots of DATN were in the Academic Television Network (ATN)

- **1980:** the Madison Academic Computing Center (MACC) operated a UNIVAC 1108 computer, and was receiving requests for remote terminals to the 1108
  - Explored twisted-pair copper cables
  - Realized that the number of connections was growing quickly, and that the copper cables would soon fill all the available conduit space around the computer sciences and statistics center building
  - Turned to a broadband data transmission system—that used radio frequency (RF) transmission over coaxial cable (Sytek Localnet), that was very much like a cable television system

Roots of DATN (Cont.)

- **1981:** several campus departments requested to use unused bandwidth for analog television transmission
- **1983:** the university implemented their first campus-wide Ethernet system over this broadband data transmission system using cable modems
- **1994:** the university created a new, higher-bandwidth cable television system to provide cable television service in dormitory rooms. This new system was called the Residential Television Network (RTN), and the older system was renamed the Academic Television Network (ATN)
  - The university purchased RTN programming from a cable television company through a contract. Part of the contract included the provision of 11 channels to the ATN. It is this contract provision that provided the basis for the agreement for channel carriage on the DATN

The Birth of DATN

- **2002:** The university was having difficulties maintaining the ATN. First, the equipment and technology were obsolete. Then, it was difficult keeping technicians with cable television experience. Finally, the funding source for the ATN was based on data transmission—when data transmission moved to fiber optic networks, the operating revenue for the ATN dried up
- **2002:** ATN shut down
- **2004:** The university and the cable provider amended the cable television contract to distribute the television channels formerly used on the ATN to a new system, called the Digital Academic Television Network. DATN is operated over the new UW-Madison Twenty First Century Network

To a Twenty First Century Network

- Growth of the campus data network
  - **1980:** serial terminal connections to UNIVAC 1108
  - **1983:** 10-Mbps Ethernet over broadband coaxial network
    - An RF network very similar to a cable television system
    - Video first shared this data network: ATN is born
  - **1986:** 10-Mbps bridged Ethernet over fiber
  - **1989:** 100-Mbps Fiber Distributed Data Interface (FDDI)
  - **1996:** 622-Mbps Asynchronous Transfer Mode (ATM)
  - **2002:** 10-Gbps Ethernet—the Twenty First Century Network
    - Funded in part from a generous grant from John Morgridge (Mr. Morgridge is chairman of Cisco Systems and a UW alumnus)
    - Basis for delivery of video over IP: DATN is born

To a Twenty First Century Network

- The Twenty First Century Network is our answer to the greatest network challenge of our time: how to meet the exponential growth of Internet traffic
  - Challenges
    - Exponential traffic growth
    - Limited budget growth
    - 30 major departments, 30 departmental LANs; many smaller departments, units, and centers

To a Twenty First Century Network

Solutions

- Multiple management models
  - Central, collaborative, delegated
- Eliminate multiple transports
- Converge everything to IP
- Standardize on limited equipment set
- Minimize manual administration, configuration, and management
- Use automated, web-based tools
- Change the revenue model
  - Old model was based on bandwidth
  - New model based on people—information workers
  - Ongoing costs—including replacement—factored into rate

To a Twenty First Century Network

Support for IP multicast

- Critical to deployment of services such as video delivery
- Allows for one or more hosts to “listen” to a stream, with no impact on the server or network beyond the initial stream; whether one client or one thousand is watching CNN, the impact on the overall network is the same
- Delivery scope can be inherently managed by the topology of the network
- For more information, see http://multicast.internet2.edu

DATN: Why QuickTime?

- Open standards
  - MPEG-4, MPEG-4 Part 10 (H.264, MPEG AVC)
- Flexible content delivery
  - Using open standards allows us to reach widest range of clients and devices
- Cost
  - Hardware
    - Xserve less expensive than dedicated products
    - Multiple streams possible with single server
  - Software
    - QuickTime Player: free for Mac OS and Windows—key!
    - QuickTime Broadcaster: free
    - QuickTime Streaming Server: included with Mac OS X Server

DATN: Why QuickTime? (Cont.)

QuickTime capabilities

- QuickTime Text Track allows us to stream closed captioning content independent of video
- QuickTime Skins allows us to use flexible approaches for the display of video on the client end
- Because of the granularity of the system, other uses of the content can be explored
  - Closed captioning search database
  - Video archival
  - Custom players and other applications
  - Computer “set top box” configurations

DATN Pilot Deployment Hardware

- Xserve head node
  - Service web front end
  - Monitors streaming nodes
  - Monitor, keyboard, mouse for local administration
- Multiple Xserve cluster node streaming nodes
  - Run streaming services for video, audio, and captioning
- Support equipment
  - FireWire audio/video converters
  - Rackmount TV tuners and PCI TV tuner cards
  - Closed-captioning decoders

DATN Pilot Deployment Hardware (Cont.)

- Xserve head node
  - Dual processor Xserve G4 (soon to be G5)
  - Flat-panel monitor, Bluetooth keyboard and mouse
- Multiple Xserve cluster node streaming nodes
  - Dual processor Xserve G4 cluster node (soon to be G5)
- Support equipment
  - Canopus ADVC-100 digital video converter
  - Blonder Tongue ZDM series and Miglia PCI TV tuners
  - TextGrabber GP500 closed-captioning decoder

DATN Pilot Deployment Software

- Server
  - Mac OS X Server
  - QuickTime Broadcaster
  - QuickTime Streaming Server
  - Apple Remote Desktop
  - Server Monitor
  - hp OpenView
- Client
  - QuickTime Player on Mac OS or Windows
  - Open source players on Mac OS, Windows, and many other platforms: VideoLAN Client (VLC)
  - Any MPEG-4 compliant device
  - Mac mini in “set top box” configuration

DATN Pilot Deployment Software (Cont.)

- Each Xserve boots, and automatically logs in as the broadcasting user (`datn`)
- In the event of an anomaly, the machines will automatically reboot themselves via `watchdog`. The machines are also monitored by Server Monitor and hp OpenView
- QuickTime Broadcaster is started via AppleScript upon login with the appropriate settings:

```
tell first document of application "QuickTime Broadcaster"
        start
end tell
```

- Closed-captioning capture and database archival script started and monitored by entry in `/etc/watchdog.conf`:

```
cc:respawn:/usr/local/cc/cc.py
```

DATN Pilot Deployment Software (Cont.)

- Entry in DATN's crontab spawns Broadcaster monitor

```
* * * * * /usr/local/sbin/qtbmon
```

- Script relaunches Broadcaster if not running

```
#!/bin/sh

/bin/ps auxwww | /usr/bin/grep Broadcaster | /usr/bin/grep -v
grep > /dev/null 2>&1

if [[ $? = 1 ]]; then
        open -a /Applications/"QuickTime Broadcaster Start.app"
        echo `date` >> /Users/datn/Library/Logs/qtbmon.log
fi
```

What's New?

- QuickTime 7!
  - H.264
    - Requires about twice the processing power of MPEG-4
    - Delivers about twice the image quality at same data rate
  - Standard-definition TV quality streams are possible in under 1.5 Mbps
- Improvements in QuickTime Broadcaster 1.5 and QuickTime 7 also make much higher quality streams possible
  - Formerly, QuickTime Broadcaster discarded half of the vertical frames of DV input
  - QuickTime Broadcaster 1.5 with QuickTime 7 now supports full frame (720 x 480) DV
  - QuickTime Broadcaster 1.5 with QuickTime 7 now supports full frame (640 x 480) from Miglia AlchemyTV card

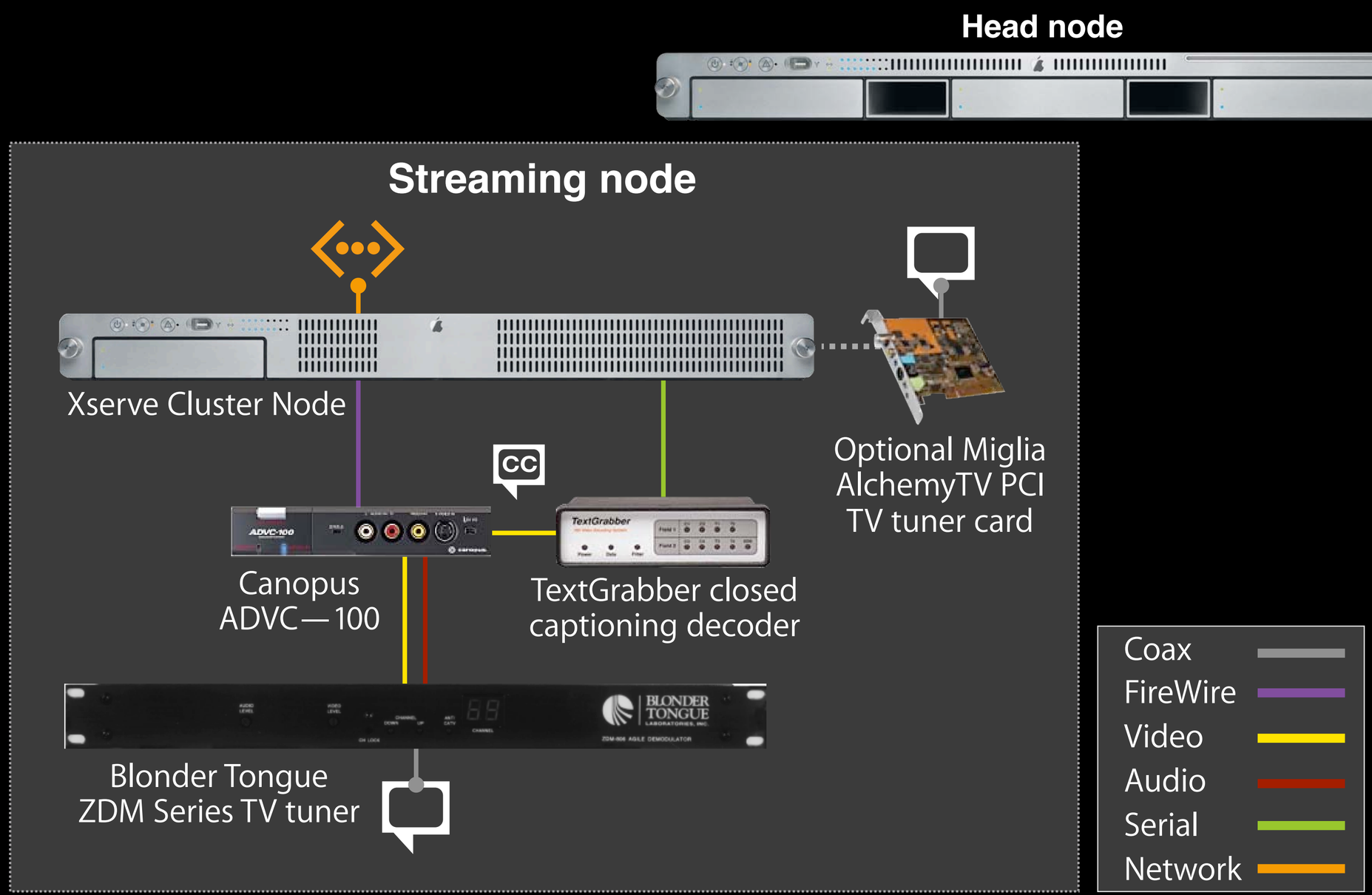
DATN Player

- Cocoa-based application provides a television-like interface for the Digital Academic Television Network for Mac OS X
- Provides a remote control, channel name and number, and other status overlays, presets, and basic support for closed captioning where available
- Retrieves channel information, logos, and lineup via MySQL from a central database server
- Support for full-screen playback without QuickTime Pro
- Developed by Brian Deith of the UW School of Journalism and Mass Communication
  - Example of the type of flexibility QuickTime offers

Text and Video Archival

- All closed-captioning text is captured via a script, indexed, and inserted into a MySQL database
- Companion video-still thumbnails are captured from each channel every minute and indexed and inserted into the database as binary objects
- A custom PHP-based web page developed in cooperation with Brian Deith at the UW School of Journalism enables searching and retrieval of the archived content
- Video is currently archived on a test basis; recording is done via QuickTime Broadcaster's integrated functionality and completed video files are processed and stored on a central streaming server
- Video is retrieved using specially crafted SMIL URLs
- Demonstration shows potential for campus-wide "TiVo"

Typical DATN Node



What Does DATN Look Like?

http://developer.apple.com/wwdc2005/

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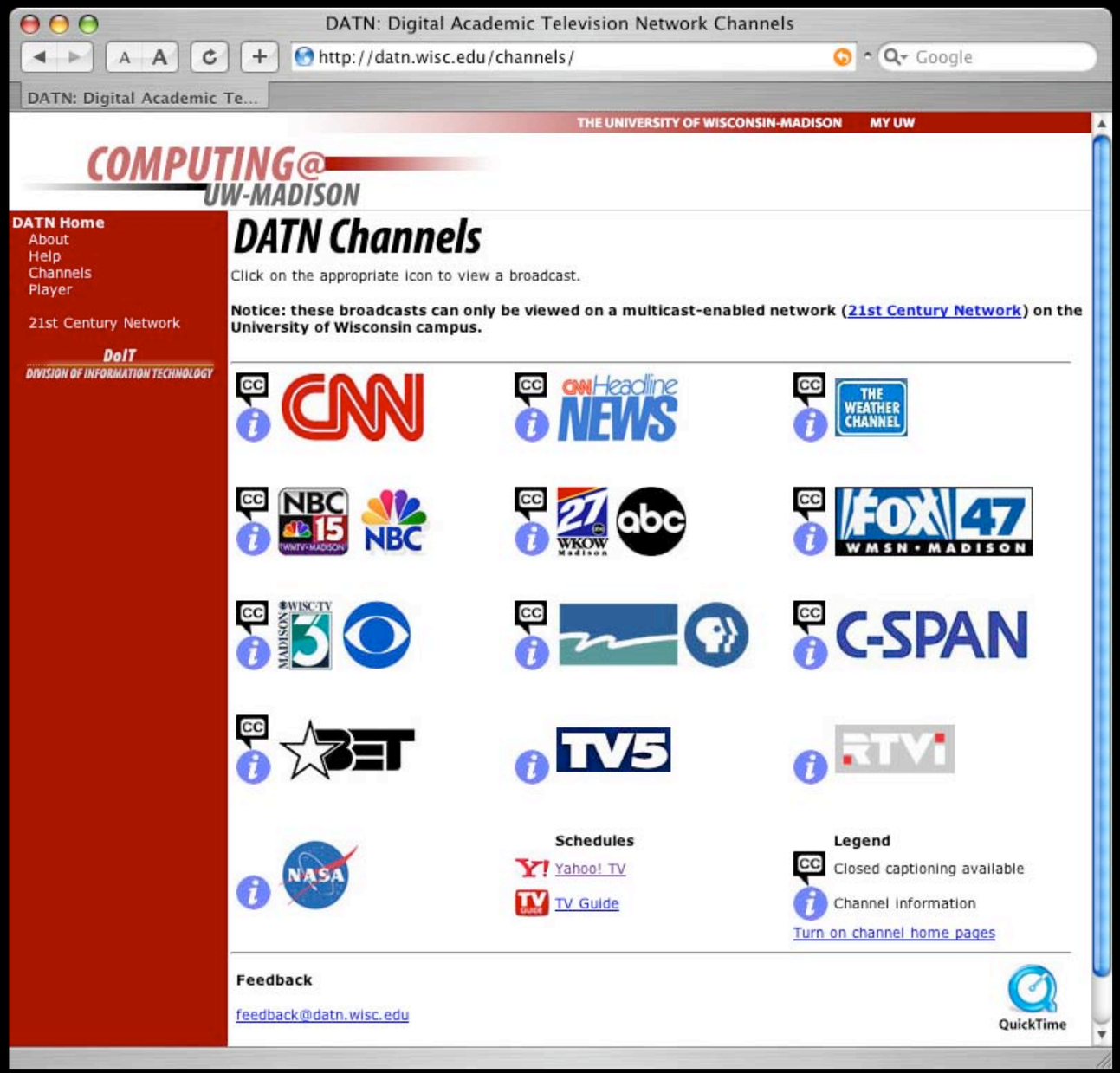

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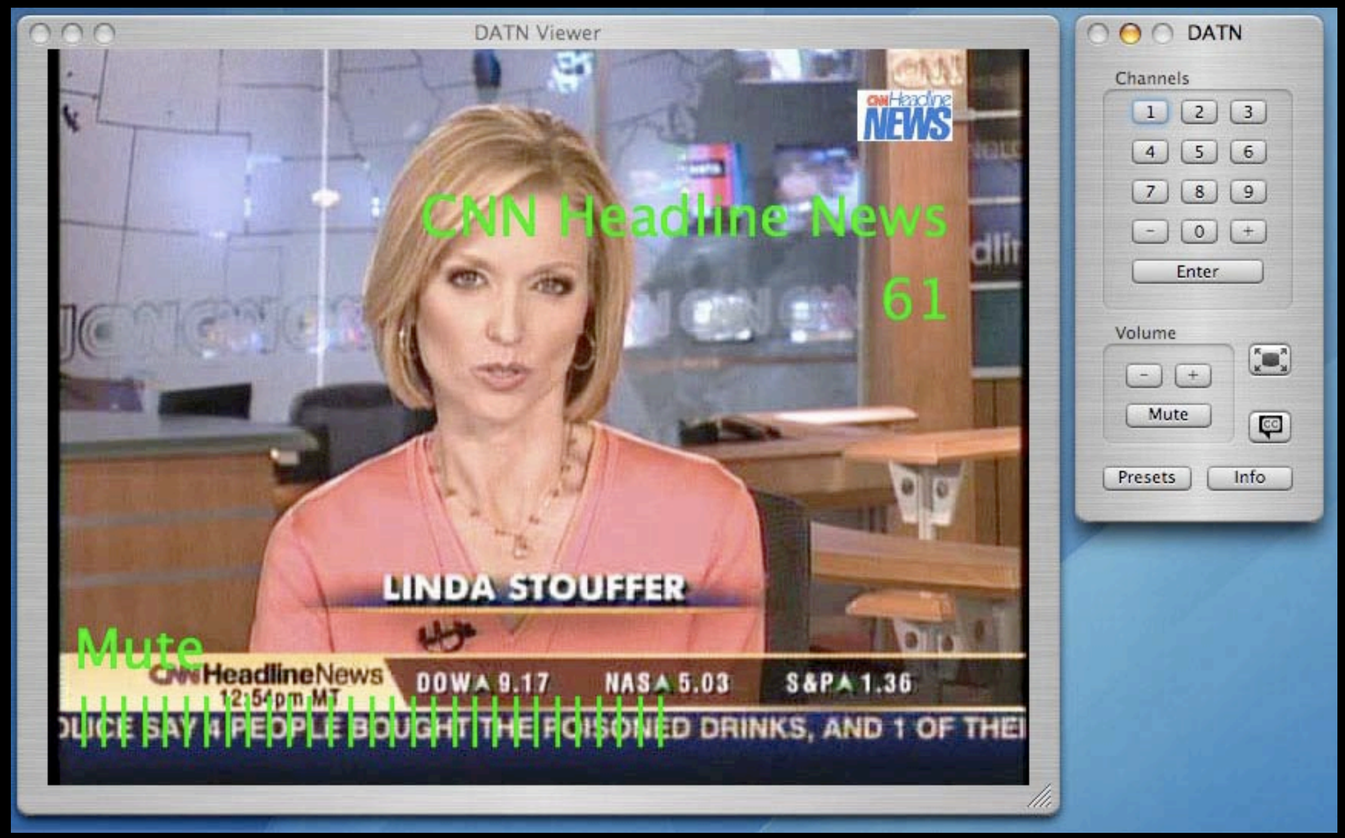

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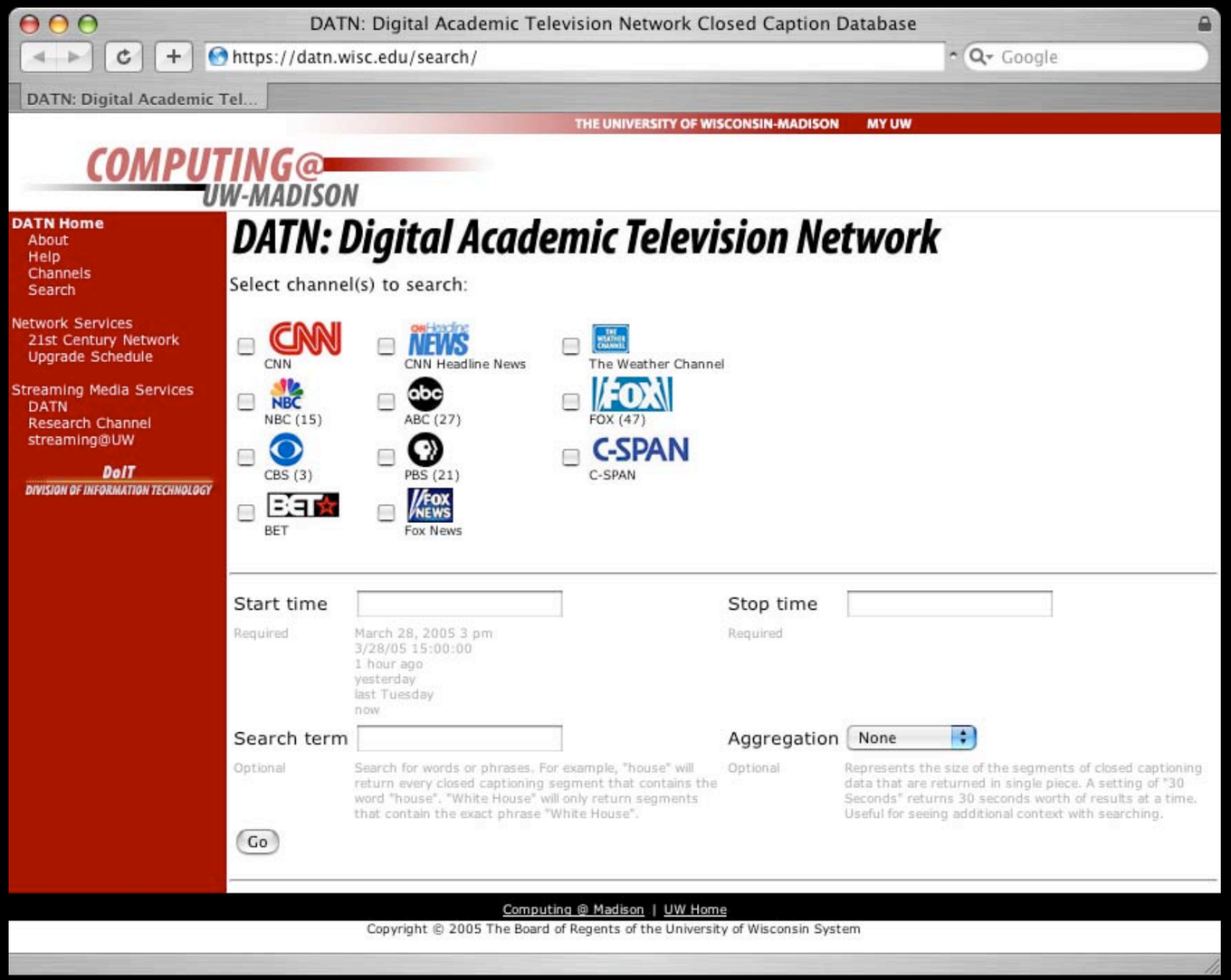

What Does DATN Look Like?

Demo

http://developer.apple.com/wwdc2005/

DATN: Going Forward

- Move to Xserve G5 and H.264 for encoding platform
- Move to QuickTime 7 as supported player
- Continue to develop text and video searching
- Expansion to 77 channels in progress
- Explore campus-wide video archive
  - Content can be archived for 45 days before copyright permission comes into play
- Continue to develop DATN Player
- iChat (with iChatUSBCam) allows TV channels or other video content to be “invited” to video conferences, including multiperson conferences
- Work with cable operator to encourage provision of content via IP multicast

Who to Contact

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For More Information

http://datn.wisc.edu/

http://developer.apple.com/wwdc2005/

Q&A

http://developer.apple.com/wwdc2005/

WWDC2005

Worldwide Developers Conference